Pentode— Beam Power Tube

For Combined Limiter, Quadrature-Grid Discriminator, and Audio Power Output Applications in FM and TV Receivers

DUODECAR TYPE

Electrical:

Heater Characteristics and Ratings:

Voltage (AC or DC)	6.3 ± 0.6	volts
Current at heater volts = 6.3	0.950	amp
Peak heater-cathode voltage:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200[a] max.	volts

Direct Interelectrode Capacitances:[b]

Beam Power Unit:		
Grid No.1 to plate	0.2	pf
Input: $G1_B$ to (K_B+$G3_B$,$G2_B$,H)	11	pf
Output: P_B to (K_B+$G3_B$,$G2_B$,H)	7.0	pf
Pentode Unit:		
Grid No.1 to plate	0.01	pf
$G1_P$ to (K_P+IS,P_P,$G3_P$,$G2_P$,H)	4.0	pf
$G3_P$ to (K_P+IS,P_P,$G2_P$,$G1_P$,H)	3.2	pf

Mechanical:

Operating Position	Any
Types of Cathodes	Coated Unipotential
Maximum Overall Length	2.375"
Seated Length	1.750" to 2.000"
Diameter	1.062" to 1.188"
Dimensional Outline (JEDEC 9-58)	See *General Section*
Bulb	T9
Base	Small-Button Duodecar 12-Pin (JEDEC E12-70)
Basing Designation for BOTTOM VIEW	12BT

- Pin 1 - Heater
- Pin 2 - Beam Power Grid No.2
- Pin 3 - Beam Power Cathode, Beam Power Grid No.3
- Pin 4 - Pentode Plate
- Pin 5 - Pentode Grid No.3
- Pin 6 - Pentode Grid No.2
- Pin 7 - Pentode Grid No.1
- Pin 8 - Pentode Cathode, Internal Shields
- Pin 9 - Beam Power Plate
- Pin 10 - No Internal Connection
- Pin 11 - Beam Power Grid No.1
- Pin 12 - Heater

PENTODE UNIT — LIMITER & DISCRIMINATOR SERVICE

Maximum Ratings, *Design-Maximum Values:*

Plate Supply Voltage	330	volts
Grid-No.3 (Quadrature-Grid) Voltage	c	
Grid-No.2 (Accelerator-Grid) Voltage	110	volts
Grid-No.1 (Limiter-Grid) Voltage:		
Positive-peak value	60	volts
Cathode Current	13	ma

Typical Operation:

Input-Signal Center Frequency	*4.5*	*10.7*	*10.7*	*Mc*
Plate Supply Voltage	270	85	285	volts
Plate Voltage	62	121	122	volts
Grid-No.3 Voltage	c	c	c	c
Grid-No.2 Voltage	100	55	100	volts
Cathode-Circuit Resistance[d]	200-400	200-400	200-400	ohms
Peak AF Output Voltage	16.8	6	16.6	volts
Minimum Grid-No.1 Signal Voltage (RMS) for AM rejection[d]	2	1.25	2	volts
Minimum Grid-No.1 Signal Voltage (RMS) for limiting action[e]	1.25	1.25	1.25	volts
Plate Current	0.44	0.25	0.49	ma
Grid-No.2 Current	10	4.1	9.8	ma
Plate Load Resistor	0.33	0.085	0.33	megohm
Linearity Resistor	1000	470	1500	ohms
Integrating Capacitor	0.001	0.002	0.001	μf
Coupling Capacitor	0.25	0.25	0.01	μf
Frequency Deviation	±25	±75	±75	kc
AM Rejection:				
For grid-No.1 signal volts (RMS) = 2	25	31	20	db
For grid-No.1 signal volts (RMS) = 3	30	30	29	db
Total Harmonic Distortion	1.8	2	1.6	%

BEAM POWER UNIT — AMPLIFIER — Class A_1

Maximum Ratings, *Design-Maximum Values:*

Plate Voltage	275	volts
Grid-No.2 (Screen-Grid) Voltage	275	volts
Plate Dissipation	10	watts
Grid-No.2 Input	2	watts

Typical Operation and Characteristics:

Plate Voltage	250	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 (Control-Grid) Voltage	-8	volts
Peak AF Grid-No.1 Voltage	8	volts

Zero-Signal Plate Current.	35	ma
Max.-Signal Plate Current.	39	ma
Zero-Signal Grid No.2 Current.	2.5	ma
Max.-Signal Grid No.2 Current.	7	ma
Plate Resistance (Approx.)	0.1	megohm
Transconductance	6500	μmhos
Load Resistance.	5000	ohms
Total Harmonic Distortion.	10	%
Max.-Signal Power Output	4.2	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.25	megohm
For cathode-bias operation	0.5	megohm

[a] The dc component must not exceed 100 volts.

[b] Without external shield.

[c] For proper operation of the pentode unit of the type shown in the accompanying Typical Quadrature-Grid-FM Detector Circuit, the Q of the tuned circuit (L_1, C_6) should be sufficiently high to develop a 4-volt rms signal at the quadrature grid when a 2-volt rms signal at the center frequency is applied to grid No.1.

It is recommended that L_1 be shunted by a capacitance of at least 10 μμf. This capacitance may be composed of tube capacitance, stray capacitance, the distributed capacitance of L_1, and a fixed capacitor.

[d] The cathode-circuit resistance should be adjusted for maximum AM rejection at the AF output of the circuit at the specified grid-No.1 signal voltage. AM rejection is measured with an applied signal containing 30 per cent amplitude modulation and 30 per cent frequency modulation.

[e] At signal levels above specified value, limiting is within ±3 decibels.

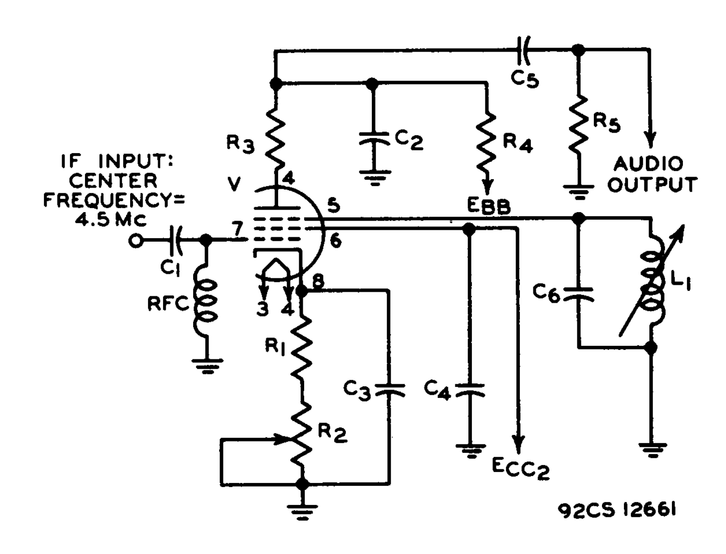
OPERATING CONSIDERATIONS FOR PENTODE UNIT

To insure proper phasing of the signal voltage developed at the quadrature grid, the components of the quadrature-grid circuit should be shielded from those of the control-grid circuit.

To obtain a symmetrical discriminator-response curve, the plate currents for no input signal and for unmodulated input signal should be equal. To assure this equality, it is necessary that the plate voltage and grid-No.2 voltage have the proper values.

The proper plate voltage for any grid-No.2 voltage may be determined from the accompanying *Operating Characteristics, Pentode Unit* curve. This curve may also be used to determine the average dynamic plate current for any combination of grid-No.2 voltage and plate voltage.

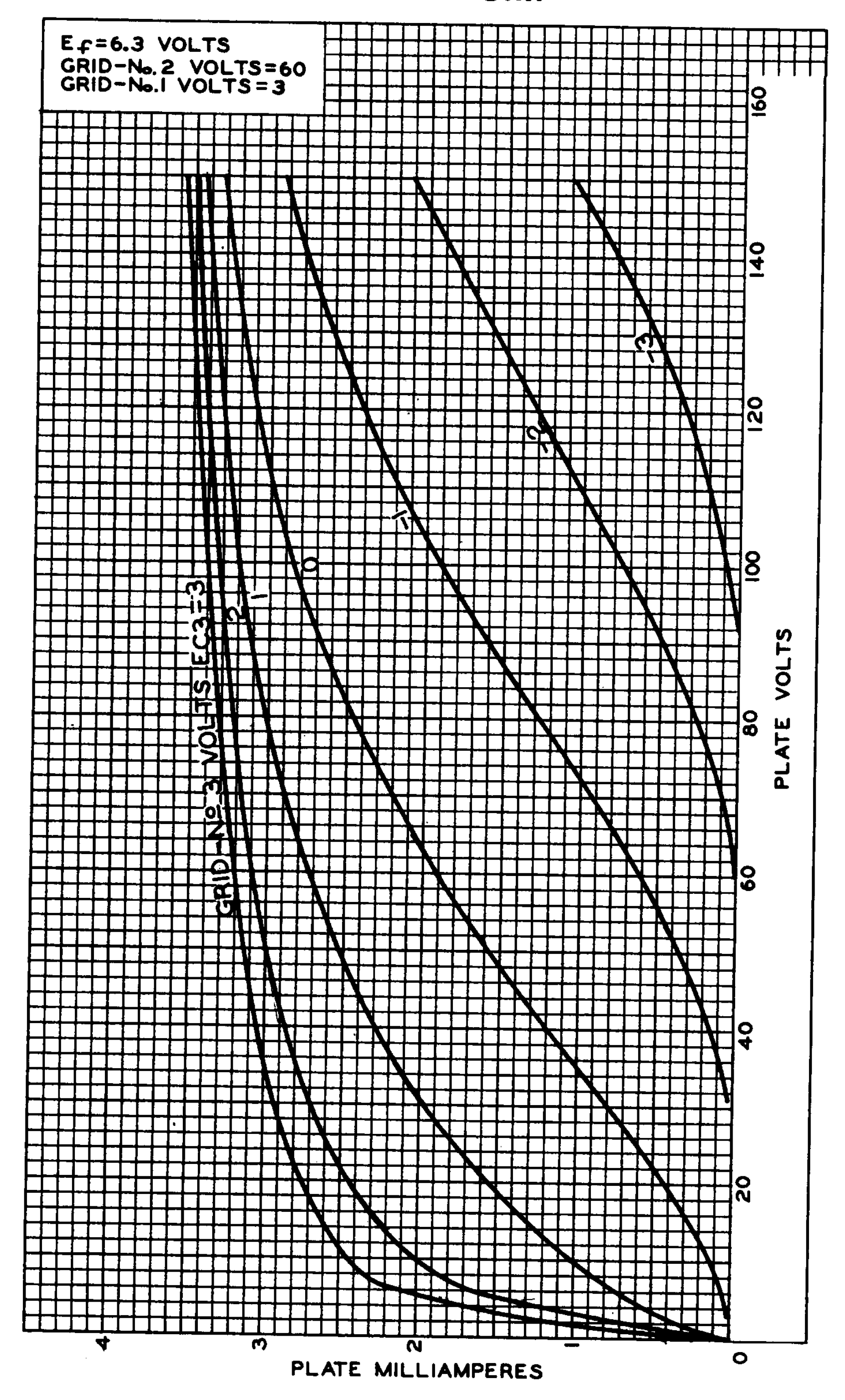
TYPICAL QUADRATURE-GRID-
FM-DETECTOR CIRCUIT



C_1:	100 μμf	R_3:	Linearity resistor, 1000 ohms
C_2:	Integrating capacitor, 0.001 μf	R_4:	Plate-load resistor, 0.33 megohm
C_3,C_4:	0.01 μf	R_5:	0.47 megohm
C_5:	0.25 μf	V:	Pentode Unit of Electron-tube-type 6J10
C_6:	10 μμf[c]		
L_1:	c		
R_1:	200 ohms		
R_2:	Cathode-bias potentiometer, 200 ohms		

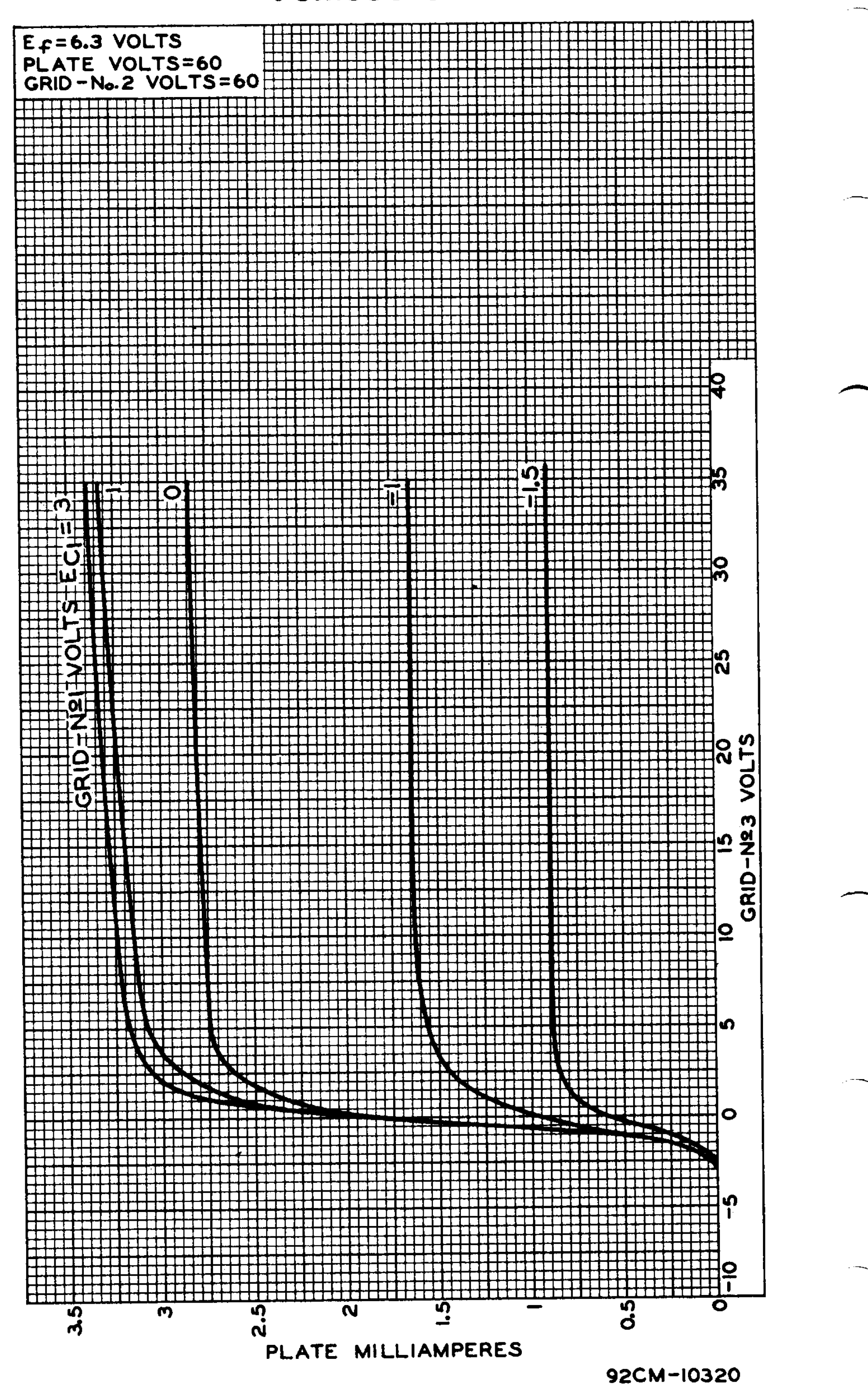
[c] For footnote see end of data.

AVERAGE PLATE CHARACTERISTICS
Pentode Unit



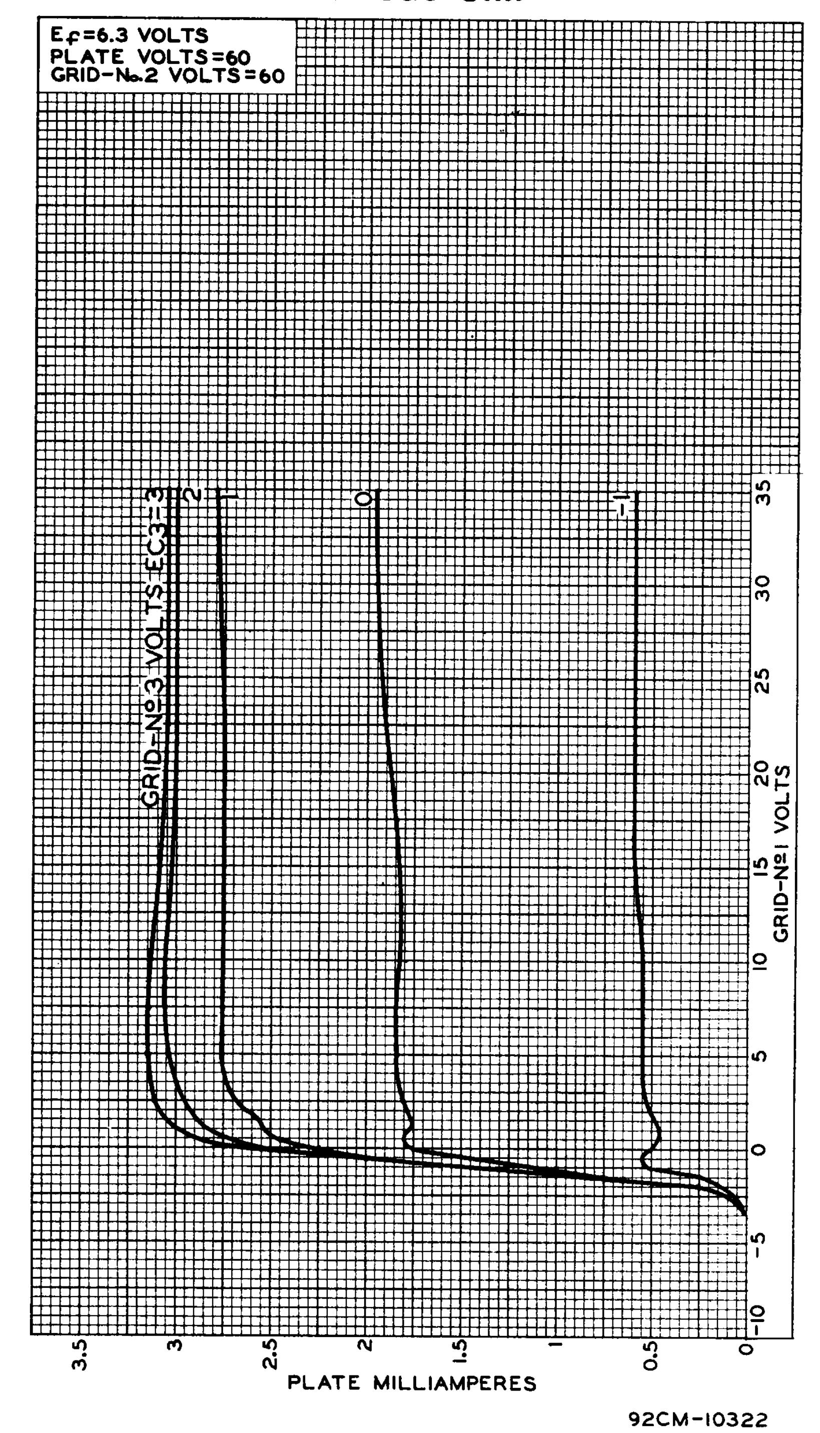
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AVERAGE CHARACTERISTICS
Pentode Unit



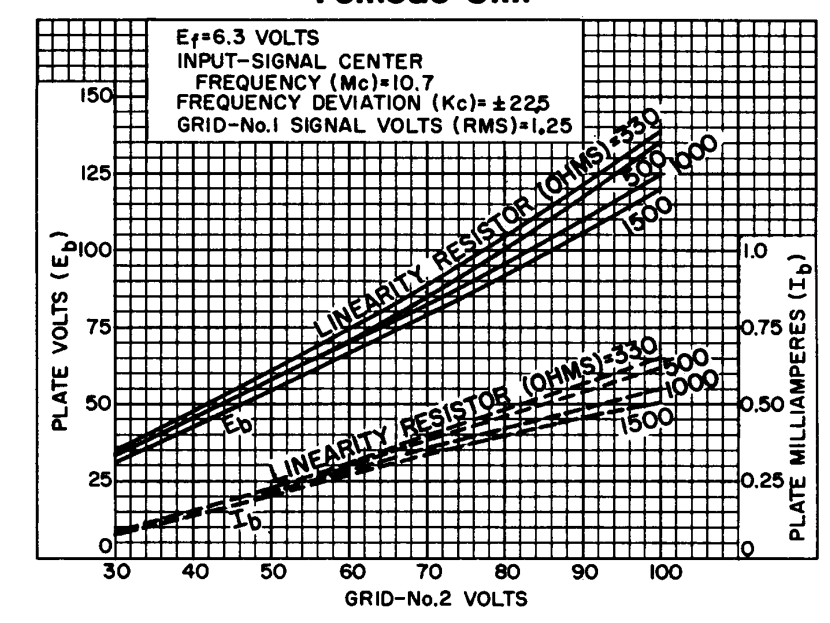
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AVERAGE CHARACTERISTICS
Pentode Unit



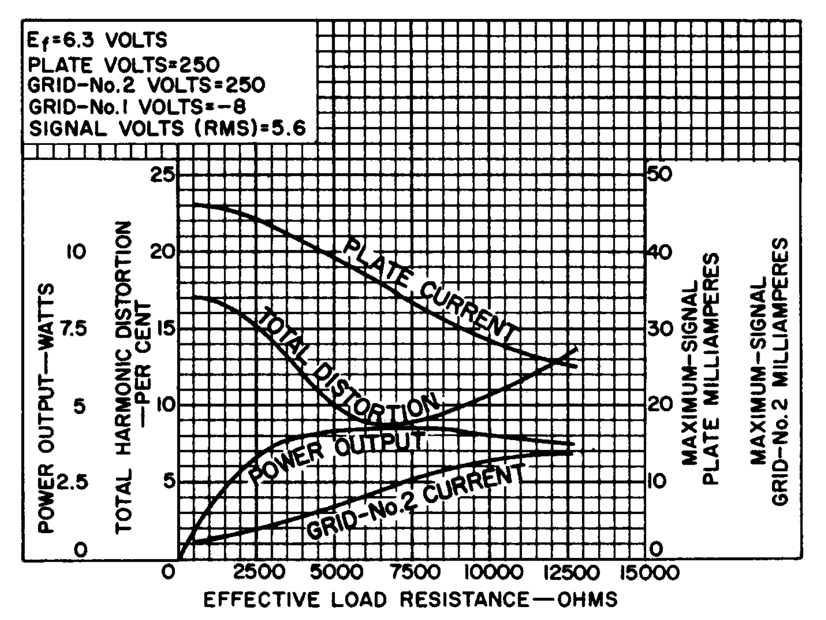
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OPERATION CHARACTERISTICS
Pentode Unit



92CS-12662

OPERATION CHARACTERISTICS
Beam Power Unit



92CS-12663

AVERAGE CHARACTERISTICS
Beam Power Unit

